

STUDIES IN THE BIOLOGY OF THE LEECH. I.*

THE SUBEPIDERMAL NERVE PLEXUS OF THE LEECH *Haemopsis marmoratis* (Say).

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INTRODUCTION.

A subepidermal network of nerve fibers similar to the one I have observed in the leech *Haemopsis marmoratis* (Say), was observed in the epidermis of the earthworm by Retzius (1892), Smirnow (1894), Langdon (1895), Smallwood (1923) and Hess (1925). The subepidermal nerve plexus has not been previously described for the Hirudinea.

The purpose of this paper is to present a description of the subepidermal nerve plexus for the leech *Haemopsis marmoratis* (Say), and the relation of this plexus to the muscles of the body wall, the epidermis and the central nervous system.

In a study of the nervous and muscular systems of the leech a definite nerve plexus was evident in the region between the bases of the epidermal cells and the basement membrane. A further investigation disclosed the nature of this plexus.

MATERIALS AND METHODS.

For the experimental work it was found desirable to use a single species of leech. The members of this group differ in habits and nerve patterns as well as in the nature of the integument and connective tissue. *Haemopsis marmoratis* (Say) was selected because of its abundance in this locality (Columbus, Ohio). This species was further useful since it is a leech of large size and can be kept for considerable time in the laboratory.

N. Chandler Foote's modification of the Bielchowsky's ammoniacal silver method was used in the preparation of nervous tissue. Gross dissection with the aid of the Barrows' binocular bridge and 2% osmic acid were profitable.

*This is the first in a series of studies devoted to the anatomy and behavior of the leech.

THE SUBEPIDERMAL NERVE PLEXUS.

This part of the nervous system is composed of anastomosing nerve fibers which form a network in the region between the bases of the epidermal cells and the basement membrane. Branches from this plexus innervate the epidermis as well as the muscle layers. This network of nerves represents structurally, as well as physiologically, a true nerve plexus. This plexus differs from the other phases of the nervous system in that it shows no signs of the characteristic metamerism of the animal. This network surrounds the entire body. There are four regions of concentration of the subepidermal network located as follows: two regions just lateral to the mid-dorsal line and two just lateral to the mid-ventral line. (See Figure 2.)

From the epidermal sense cells arise neurofibrillae which extend into the subepidermal plexus. (Whitman, 1888.) From the subepidermal nerve plexus both intercellular and intracellular nerve fibers extend into the epidermis. From this plexus nerve fibers also extend inward innervating regions supplied by branches of the peripheral nerves. The subepidermal region is connected with the central nervous system through nerve trunks extending between the ganglia in the cord and the region of the epidermis. Branches of these epidermal nerve trunks innervate the subepidermal plexus as well as the epidermal cells. These nerve trunks are most obvious in the leech in the regions of the concentration of the subepidermal nerve plexus. (See Figures 2 and 3.)

From these observations and unpublished experimental data it is obvious that a definite relationship exists between the subepidermal nerve plexus, the muscles of the body wall, and the central nervous system. It is only on the basis of this deduction that certain expressions of behavior can be adequately explained. (Details of experimental proof and explanation will follow in a later number of this publication.)

The accompanying diagrams and photomicrographs will give a clearer conception of this system in the leech.

SUMMARY.

- (1) A subepidermal nerve plexus is present in the leech.
- (2) The subepidermal nerve plexus is a network of anastomosing nerve fibers between the epidermal cells and the basement membrane.

- (3) The subepidermal network surrounds the entire body.
- (4) There are four regions of concentration of the subepidermal plexus: two dorso-lateral and two ventral-lateral.
- (5) This system is supplied by fibers directly from the sense cell bodies in the epidermis.
- (6) From this system nerve fibers extend directly to the muscles of the body wall as well as to the central nervous system.
- (7) The subepidermal plexus serves as a reflex system of the body wall outside of the central nervous system.

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EXPLANATION OF PLATE.

- FIG. 1.** A camera lucida drawing, $\times 80$, of a ventro-lateral concentration of the subepidermal nerve plexus. Note the inter-muscular as well as the subepidermal ramifications of these fibers.
- FIG. 2.** A drawing of a cross-section illustrating the arrangement of the muscles of the body wall and showing the distribution of the subepidermal nerve plexus.
- FIG. 3.** A photomicrograph, $\times 250$, of a dorso-lateral concentration of the subepidermal and inter-muscular nerve plexus.
- KEY:** C. Circular muscle, E. Epidermis, L. Longitudinal muscle, N. Nerve trunk, S. Subepidermal nerve fibers. Note the intermuscular ramifications of the subepidermal nerve fibers.

NOTE: The technique employed in securing and staining nervous tissue was of such a nature as to insure the staining of such tissue through specific nerve stains.

